PANDA COLLABORATION MEETING

Forward Spectrometer Dipole Magnet

STATUS AND PLANS

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Main Specifications for Dipole Magnet

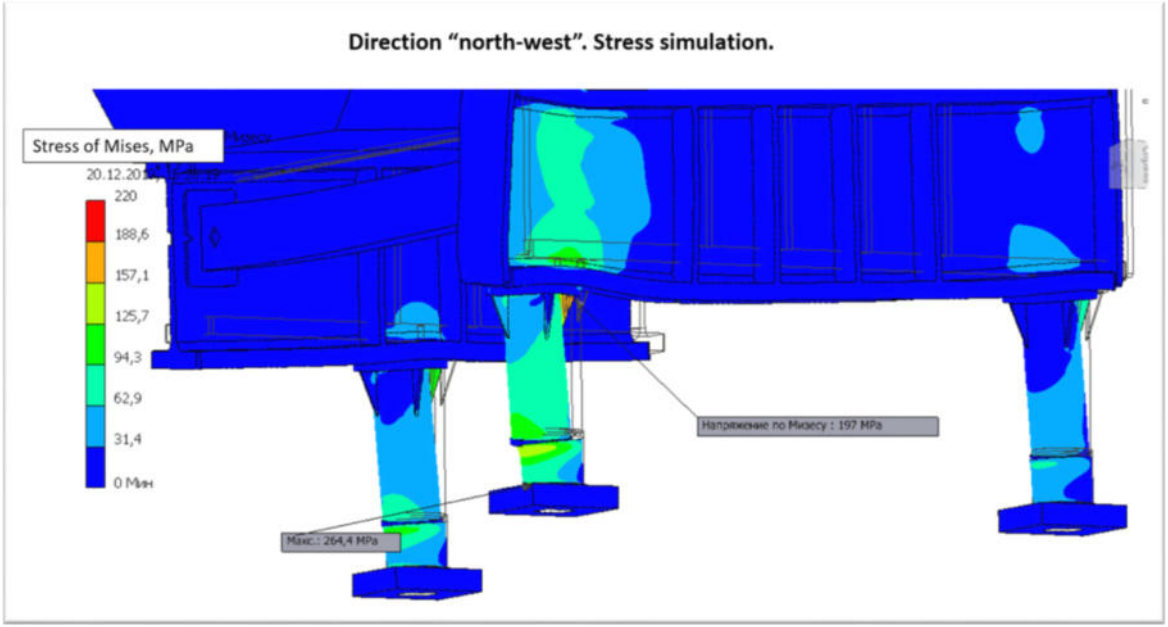
- Field integral along beam axis (z-direction) 2.0 T·m
- Aperture angle horizontally ± 10°, vertically ± 5°
- Yoke laminated to reduce eddy currents, lamination ~ 10 cm
- Total weight 240 tons
- Steel quality of yoke St-10
- Coil windings made of water cooled copper conductors
- Total dissipated power ≤ 400 kW

Stress analysis-2

To further reduce the stress and displacement:

- The leg wall thickness was increased from 20 to 30 mm.
- Six triangle girders are now installed under the flange of each of the 3 leg.
- The design of the ground plate for a common alignment of the support legs was improved.

Finally there is no area anymore with stress above the yield strength of 255 MPa for St10.



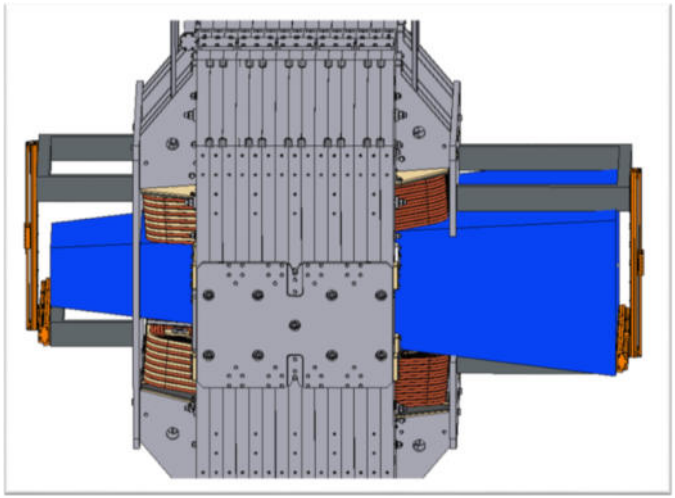
Status

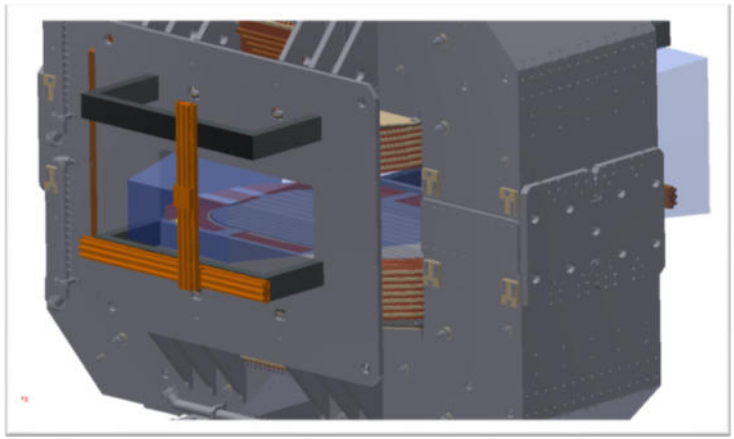
- Stress analysis completed.
- Magnetic field simulations completed.
- Design of yoke (plates, blocks, halves, assembly) completed.
- Design of support structure completed.
- Design of coils completed.
- Yoke machining technology developed.
- 3D model for entire magnet completed.
- 2D drawings derived and under checking/approval .
- Intermediate report accepted.
- Final report is in final stage of preparation, including Installation manual and other related documents.
- Magnetic mapping system is under design.
- Negotiations with steel maker and yoke machinery workshops are in process.

Magnetic measurement system for dipole.

Boundary conditions:

- using one 3D Hall sensor
- covering all area inside magnet gap
- accuracy 1 Gauss
- measuring positions in X, Y, Z.
- common control unit with Solenoid field mapping system



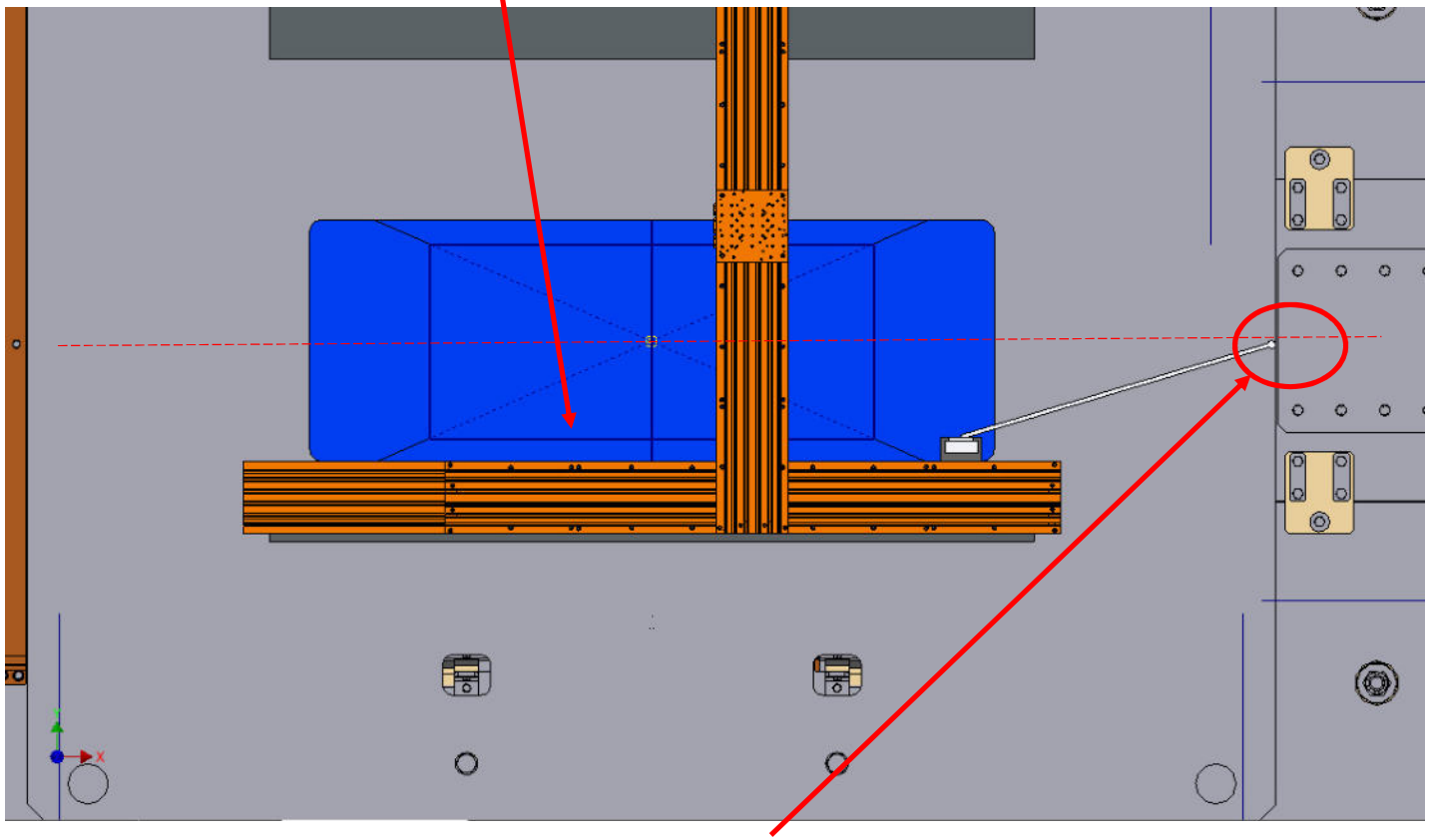


Magnetic measurement system for dipole-2.

Location of 3D Hall Sensor and Laser Reflector

Guideline and carriage

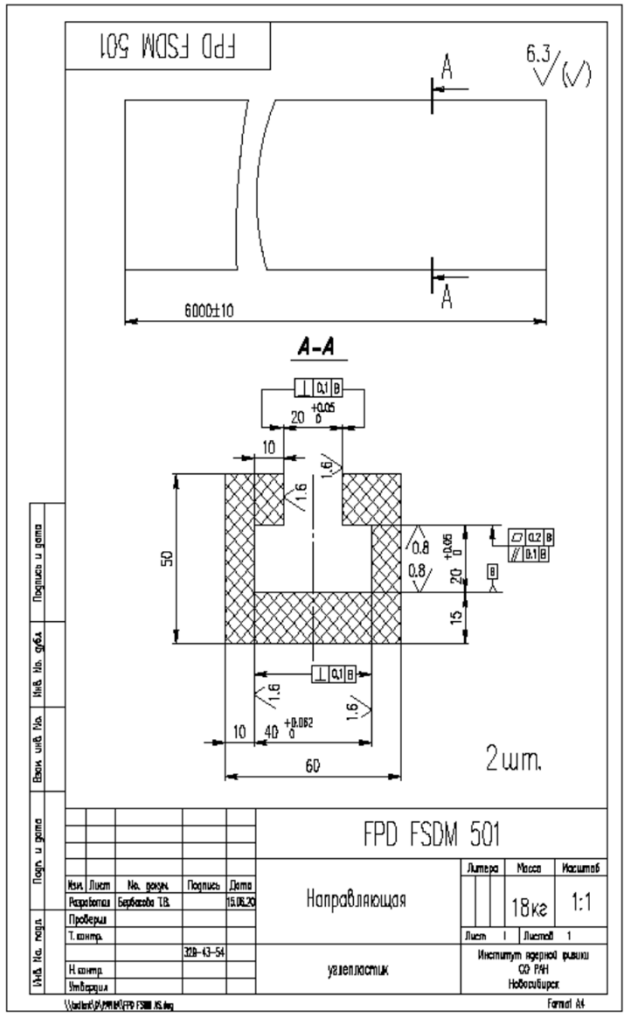
XY moving system can only move inside the area marked by blue (restriction imposed by a hole in the upstream field clamp)



Using this shape of the carriage, it is possible to measure the field near the pole surface inside the magnet gap while the guide is placed in the area of possible movement. The elongation height of the carriage was chosen so that measurements could be started below the median plane.

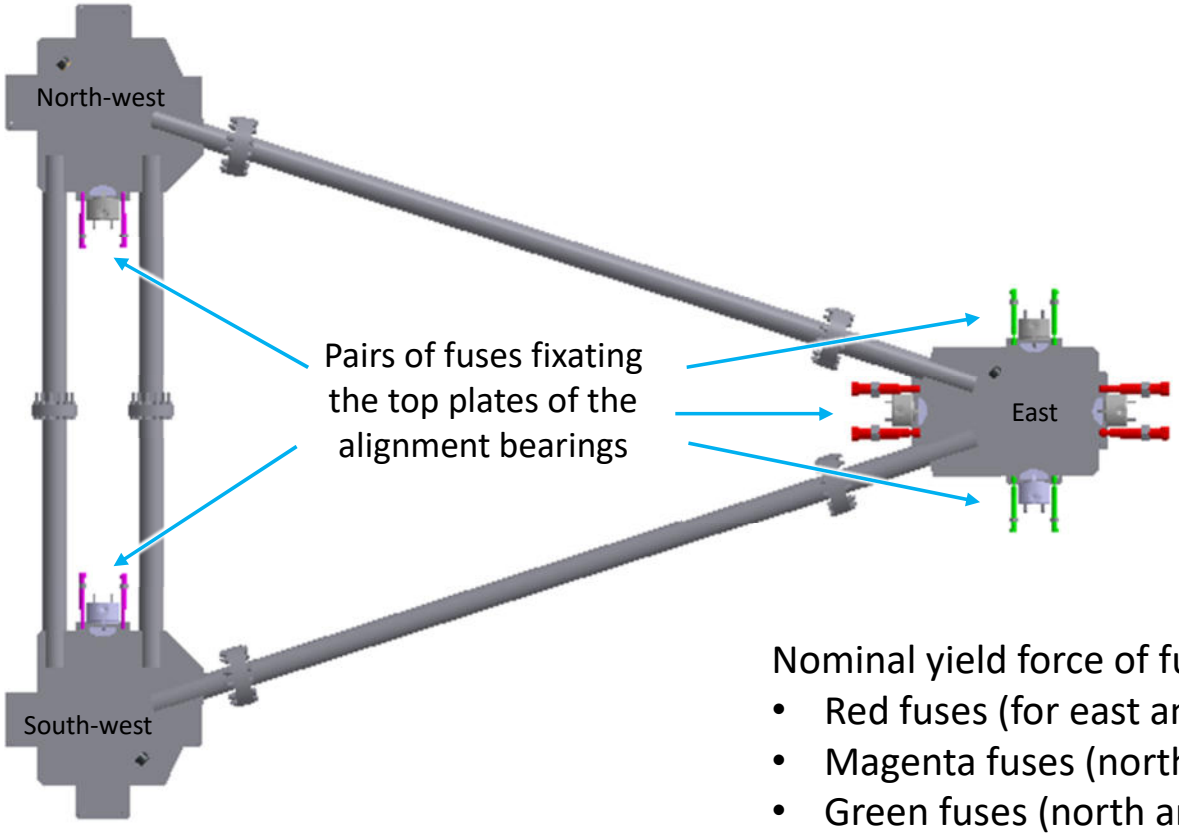
Magnetic measurement system for dipole-3.

- Guide line of carbon fiber plastic (weight 16 kg for 6 m)
- Sag of guide line is 1.5 mm (inclination angle is 0.06 deg.) => at points with large Bz the error to By is about 4-5 G.
- => Carriage with 3 tracker mirrors and one 3D Hall sensor (weight 2 kg) for measuring field, coordinates and angle.
- Selecting a reliable and inexpensive moving system (NEWPORT is good, but expensive).



Fuses used to fixate the aligned magnet

The 3 support legs of the magnet are designed to carry a horizontal load of no more than 100 kN (10 tons). In order to protect the legs in case of a big seismic event, bolts (fuses) with defined cross sections and yield strength are employed. The fuses will keep the magnet in place if the seismic event is of medium magnitude (equivalent static acceleration ~0.7 m/s²), they will yield if the seismic acceleration will be more than 0.8 m/s².



Nominal yield force of fuses:

- Red fuses (for east and west direction) 48 kN each
- Magenta fuses (north and south direction) 32 kN each
- Green fuses (north and south direction) 16 kN each

Plans

- **2D drawings: correction by BINP and checking by GSI to be completed.**
- **Final report will be finished till March 31.**
- **New fuses setup will be tested soon aiming at reliable and sharp dipole relief under seismic force distributed for each supporting leg.**
- **Magnetic mapping system design will be completed soon.**
- **Developing 3D code, based on Maxwell tensor method, for precise simulations of repelling forces acting on yoke parts.**